

FY 2009 Performance and Accountability Report

Other Accompanying Information

Office of Inspector General Letter on NASA's Most Serious Management and Performance Challenges

November 13, 2009

TO: Administrator
FROM: Acting Inspector General
SUBJECT: NASA's Most Serious Management and Performance Challenges

As required by the Reports Consolidation Act of 2000, this memorandum provides our views of the most serious management and performance challenges facing NASA and is to be included in the Agency's Performance and Accountability Report for fiscal year 2009.

In determining whether to report an issue as a challenge, we consider the significance of the issue in relation to the Agency's mission; its susceptibility to fraud, waste, and abuse; whether the underlying problems are systemic; and the Agency's progress in addressing the issue. We provided a draft copy of our views to Agency officials and considered all comments received.

Through various Agency initiatives and by implementing recommendations made by the Office of Inspector General (OIG) and other evaluative bodies, such as the Government Accountability Office, NASA is working to improve Agency programs and operations. However, challenges remain in the following areas:

- Transitioning from the Space Shuttle to the Next Generation of Space Vehicles
- Managing Risk to People, Equipment, and Mission
- Financial Management
- Acquisition and Contracting Processes
- Information Technology Security

During FY 2010, the OIG will continue to conduct work that focuses on NASA's efforts to meet these challenges as part of our overall mission to promote the economy and efficiency of the Agency and to root out fraud, waste, abuse, and mismanagement.

We hope that you find our views helpful. Please contact me if you have questions.

signed
Thomas J. Howard

Enclosure:
NASA's Most Serious Management and Performance Challenges

NASA's Most Serious Management and Performance Challenges

Transitioning from the Space Shuttle to the Next Generation of Space Vehicles

NASA's greatest challenge continues to be maintaining the critical skills and capabilities required to safely and effectively fly the Space Shuttle until its retirement while transitioning to the next generation of space vehicles. In 2004, the "President's Vision for U.S. Space Exploration" caused a substantive reorganization of NASA's strategic priorities, established a timeline for the retirement of the Space Shuttle, established the completion date for the International Space Station (ISS), and set the goals of returning to the Moon and reaching Mars. However, fiscal realities and technical challenges have hampered NASA's efforts to effectively implement the Vision.

Space Shuttle Program. The primary mission focus of the Space Shuttle Program between now and retirement is to launch and assemble U.S. and international components for the ISS while sustaining logistics and science support to ISS crews. Successful completion of the Space Shuttle Program's planned manifest, currently scheduled for completion by the end of fiscal year (FY) 2010, is key to meeting NASA's strategic goals of supporting the safe operation of the Space Shuttle to complete assembly of the ISS by the Space Shuttle's planned retirement.

NASA continues to fund and plan for completion of the remaining Space Shuttle flight manifest, which is required to complete the ISS, by September 30, 2010. However, indications from historical flight rates, the presidentially directed Review of U.S. Human Space Flight Plans Committee (the Augustine Committee), internal NASA evaluations, and work by the NASA Office of Inspector General (OIG) show that this goal is not likely to be achieved by the end of FY 2010. If NASA is required to extend the Shuttle's flight schedule, the Agency will need to reevaluate the adequacy of funding and plans for the sustainability of the Shuttle's workforce and infrastructure while preserving the robust process for voicing safety and engineering concerns.

Constellation Program. NASA began the Constellation Program in 2005 to facilitate the President's Vision for return to the Moon and the human exploration of Mars. However, reviews of various components of the Program have concluded that allotted resources are not sufficient for stated requirements.

The largest expenditure of funds within the Constellation Program—\$10 billion—has been for the development of the Ares I crew launch vehicle and the Orion crew exploration vehicle. Yet, according to the Government Accountability Office (GAO), NASA cannot confidently determine total costs until technical challenges have been overcome. Engineers working on the Ares I Project continue their efforts to understand and mitigate the impact of rocket thrust oscillations that some critics contend could threaten the health of astronauts and survivability of the Orion vehicle. To improve cost and schedule confidence, NASA has modified Orion's baseline configuration for initial missions, reducing the number of astronauts the vehicle will transport from six to four. To accommodate the resolution of these and other technical issues, project milestones have rightfully been delayed. NASA's meticulous application of a disciplined approach for each life-cycle phase review will help ensure that complete, timely, and essential information is provided for informed decision making.

Unity of effort is essential for executing a program as complex as Constellation within the fiscal resources provided while ensuring the safe, efficient, and effective implementation of its projects, such as Orion. Over the past year, the Constellation Program has been the subject of multiple studies and analyses. In addition to internal life-cycle reviews associated with standard program management, reviews conducted by the Agency for the President, OIG, GAO, and the Augustine Committee have all examined and reported on the progress of various components of the Constellation Program. Each review noted that allotted resources did not match stated requirements, which resulted in the modification of requirements and the delay of significant milestones.

Managing the Transition. NASA faces several transition challenges, among the greatest are the gap period between the last planned Shuttle flight in 2010 and the first planned Ares I and Orion flight in 2015, the sustainment of the ISS after the last Space Shuttle mission, and the effective management of civil service and contractor personnel assigned to the Space Shuttle Program and the Constellation Program.

Over the past year, at the request of Congress and the Administration, NASA has provided various options for extending Shuttle operations and closing the gap between the planned retirement of the Space Shuttle and the first piloted space flight of the Constellation Program's Orion crew exploration vehicle. While each option is technically

feasible, each option results in a higher cumulative safety risk because each involves an increased number of Space Shuttle flights, and additional funding would be required to avoid negatively impacting implementation of the next generation of space vehicles.

Two plans that NASA developed—one for an extension of the Shuttle Program to 2012 and another for extension to 2015—would cost an estimated \$4.7 billion and \$14 billion, respectively. These costs would have to be taken out of other NASA programs unless they were provided as an addition to the baseline budget. Each plan would require close coordination with the Constellation Program to avoid negatively impacting the development and implementation of the Program. In addition, the Columbia Accident Investigation Board recommended in 2003 that, as part of a Service Life Extension Program, NASA should recertify the Shuttle at the material, component, system, and subsystem levels prior to operations beyond 2010. Additional challenges to any plan to extend the Shuttle Program include recertifying suppliers who have already begun retooling efforts and reversing recent contract workforce layoffs.

The Augustine Committee presented eight options to address the gap in U.S. space flight capability; six of the options included extending ISS operations from 2015 to 2020, potentially making ISS sustainment more challenging. Providing for the sustainment of ISS is crucial to realizing the scientific research potential of the ISS and protecting the extensive U.S. and foreign investments in the ISS. NASA plans to rely on international partners and commercial providers for logistics support and crew rotation necessary to sustain and operate the ISS during the gap period of 2010 through 2015. However, while viewed by Agency officials as unlikely, there are various ISS components that can only be carried to orbit by the Space Shuttle should they have to be replaced. In addition, NASA plans to rely on the commercial sector to develop space vehicles for the bulk of cargo delivery required to maintain an ISS crew of six. However, a recent GAO report stated that although the commercial providers have made some progress in meeting established milestones, demonstration flights of their vehicles have been delayed due to engine development challenges. Significant delays in the availability of these commercial vehicles could threaten sustainment of the ISS.

Workforce issues during the gap period of 2010 through 2015 include maintaining the critical skills now present in the Shuttle workforce throughout the Shuttle's remaining flights while placing additional emphasis on defining and cultivating the skill sets needed by the Constellation Program, especially those that will be needed at Kennedy Space Center. Although other NASA Centers are engaged in development and production activities for the new vehicles, the primary focus of the Kennedy workforce is launch operations and ground processing—activities that will not be needed at levels similar to current capacity until the new crew exploration vehicles are ready for flight. Determining the appropriate balance to operate the Space Shuttle safely and sustain that program through retirement while incentivizing talented people to prepare for the future requirements of the Constellation Program demands the optimization of all human resource management assets.

Recognizing the significance of the transition being properly managed, various NASA councils (e.g. Program Management Council, Operation Management Council, and Strategic Management Council) routinely review the Space Shuttle retirement plan and progress, to include transition metrics, decisions, and impact on facilities. In addition, in July 2009, NASA published the third edition of the "NASA Workforce Transition Strategy," which detailed civil service and contractor Shuttle and Constellation workforce projections and requirements at NASA's individual Centers. As the Shuttle Program is retired and the Constellation Program enters the implementation phase of development, such efforts should entail greater detail and transparency to enable informed decision making.

Managing Risk to People, Equipment, and Mission

Ensuring the success of NASA's mission is the goal of effective risk management. Safety and mission assurance controls are key to supporting robust and reliable operations in the context of very challenging launch and mission schedules. NASA program managers are constantly confronted with risks introduced by fiscal realities, schedule demands, and ever-changing priorities. In addition, the NASA OIG has investigated instances involving damaged, counterfeit, or inferior parts purchased by NASA as a result of questionable or even criminal actions of suppliers. Technical challenges, competition for scarce resources, and U.S. economic constraints add risk to international and commercial partnerships. Close scrutiny by NASA management of adherence to the fundamentals of project and program management, risk identification and mitigation, and proven acquisition strategies is beneficial toward the accomplishment of Agency goals.

Technical Challenges. Although there is evidence of a continued, strong engineering and safety focus, technical issues continue to challenge the Shuttle Program and add risk to mission success. Specifically, NASA most recently has been troubleshooting hydrogen gas leaks and valve concerns and continued addressing the risk posed by the shedding of foam insulation from the external fuel tank. Undoubtedly, there will be unforeseen technical

challenges that will need to be addressed as long as the Space Shuttle continues operations. The stress added to schedules and budgets in an effort to meet these technical challenges is compounded by stress generated in trying to maintain the Constellation Program's development and acquisition schedule.

Ongoing technical challenges and failures in the Science Mission Directorate portfolio add to Agency stress and increase the cost of NASA programs and projects. NASA's next high-profile mission to Mars, the Mars Science Lab, suffered a major setback resulting in a missed launch opportunity in 2009, a \$400 million cost increase, and a 2 year schedule delay due to technical challenges. These challenges threaten the viability of the project, and cost increases and schedule delays may significantly impact the entire Mars Exploration Program. In addition, the Orbiting Carbon Observatory, a satellite important to the monitoring and understanding of the Earth's changing climate, suffered an undetermined technical failure on launch, resulting in the loss of the \$209 million satellite and arguably creating a gap in NASA's execution of the recommendations and intent of the National Research Council's Earth Science Decadal Survey. NASA is also continuing to work on resolving technical issues that threaten to further delay implementation of the Stratospheric Observatory for Infrared Astronomy Program, which is now 10 years behind schedule with costs exceeding 200 percent of the initial cost estimate.

Sound program and project management principles, technical and safety risk identification, and sound mitigation strategies are paramount to successfully developing and operating programs and projects that push the envelope of technological advancement. In the past year, the OIG dedicated considerable resources to reviewing the Agency's risk management efforts at the program and project levels. Although the management of risk generally appeared sound, life-cycle reviews needed to remain focused on ensuring appropriate maturity of design and emphasis was needed on ensuring the adequacy of benefit-cost analyses to provide required information for informed decision making. Our focus will continue to include monitoring NASA's implementation of requirements detailed in the NASA Policy Directive 7120 series on program and project management as well as NASA's implementation of GAO best practices and OIG recommendations.

Budgetary Challenges. Aside from the tremendous schedule and technical challenges associated with the complex science, aeronautics, and space exploration projects undertaken by NASA, accomplishment of those missions is susceptible to budgetary revisions imposed through the appropriations process. The implications associated with this budgetary reality add ever-increasing risk to an organization responsible for leading the Nation in space and aeronautics research and development and whose programs are designed to operate over several decades.

Budget revisions and the emphasis on implementing the President's Vision, National Academy of Sciences recommendations, and other stakeholder priorities also influence operations within the NASA Directorates not directly involved in the Space Shuttle or Constellation Programs. While the major space exploration and operational program challenges continue to be a difficult balancing act, other Mission Directorates within NASA, such as the Aeronautics Research Mission Directorate (ARMD) and the Science Mission Directorate, certainly feel the impact. Shifting priorities and inconsistent funding levels have delayed the development and implementation of the Landsat Data Continuity Mission and Global Precipitation Measurement projects. Decreasing budget allocations have influenced decisions throughout the ARMD portfolio, including research and development activities for the Next Generation Air Transportation System.

NASA is required to operate within the fiscal boundaries afforded and supported by the public interest. Although NASA's programs have advanced the Nation's knowledge in science and technology, the many issues facing the country have led to questions about the cost and benefits of space exploration. The debate will likely intensify as the Administration and Congress weigh the options presented by the Augustine Committee.

Key Partnerships. In light of NASA's budgetary realities, international and commercial partnerships are vital to not only implementing the President's Vision, but also improving the viability of future inter-planetary and deep-space exploration. Such partnerships involve risks that include changes in U.S. foreign relations policy and economic constraints.

The President's Vision directed NASA to pursue opportunities for international partnerships in support of the Nation's exploration goals. The Augustine Committee reaffirmed the benefits of engaging international partners in future space exploration endeavors, stating that many nations have aspirations for space exploration and U.S. leadership "could strengthen geopolitical relationships, leverage global resources, and enhance the exploration enterprise." In addition to NASA's traditional partners (Canada, France, Japan, etc.), other countries (e.g., China) that have not traditionally been considered as partners for various reasons are developing space programs, which could prove to be an asset in the future to NASA in attaining its goals.

The looming gap in U.S. human space flight capability makes engagement, cooperation, and consideration of alternatives a must for the viability of the ISS. NASA is facing significant challenges to its plan to honor its commitments to deliver cargo to the ISS. Delays in the Commercial Orbital Transportation Services Program and the likely unavailability of U.S. made crew vehicles increase the likelihood that NASA will be forced to rely solely on international partners to transport cargo and crew to the ISS.

Financial Management

Over the past year, NASA continued to make progress in improving its internal control over financial reporting by executing its Continuous Monitoring Program (CMP). The CMP assesses and evaluates internal controls, compliance with generally accepted accounting principles, and evidence used to support that balances and activity reported in NASA's financial statements are accurate and complete by requiring Centers to perform a set of control activities. Throughout FY 2009, the CMP has operated as designed. NASA has identified exceptions through the execution of the control activities and has generally tracked and resolved those exceptions in a timely manner.

Although much progress has been made in developing policies, procedures, and controls to improve NASA's financial processes and systems, challenges remain. Specifically, during FY 2009, NASA management and Ernst & Young LLP (E&Y) continued to identify deficiencies in the Agency's system of internal control, which impair NASA's ability to timely report accurate financial information. The most severe deficiency involves NASA's internal control over legacy property, plant, and equipment (PP&E). As shown in the following table, this deficiency has been reported as a material weakness for several years.

Internal Control Deficiencies						
Fiscal Year		2009	2008	2007	2006	2005
Independent Public Accountant		E&Y	E&Y	E&Y	E&Y	E&Y
Audit Opinion		Disclaimer	Disclaimer	Disclaimer	Disclaimer	Disclaimer
Internal Control Deficiencies	Property, Plant, and Equipment	material weakness	material weakness	material weakness	material weakness	material weakness
	Financial Statement Preparation Process and Oversight	—	material weakness	material weakness	material weakness	material weakness
	Environmental Liability Estimation ^a	significant deficiency	—	—	—	reportable condition
	Federal Financial Management Improvement Act ^b	significant deficiency	—	—	—	—
	Fund Balance with Treasury	—	—	—	—	material weakness
^a The deficiency cited for Environmental Liability Estimation was included in the Financial Statement Preparation Process and Oversight weakness for FYs 2006–2008.						
^b The deficiency cited for Federal Financial Management Improvement Act was included in the Financial Statement Preparation Process and Oversight weakness for FYs 2005–2008.						

Property, Plant, and Equipment. To address the PP&E material weakness, NASA implemented a PP&E capitalization policy and procedures for assets procured on or after October 1, 2007. The policy and procedures are intended to ensure that the value and completeness of capitalized assets, whether Government-held or contractor-held, will be accurate. For contracts with effective dates on or after October 1, 2007, contractors are required to report the cost of each capitalized asset as a separate item on required contractor cost reports. NASA also designed a process to reconcile the monthly contractor cost reports and the capitalized PP&E amounts recorded in NASA's Contractor-Held Asset Tracking System (CHATS) and the Core Financial module. However, given that NASA had no new contracts that fell into this category during FY 2009, E&Y could not test the effectiveness of NASA's controls surrounding those reconciliations for contractor-held property.

Currently, the weakness in PP&E is focused primarily on controls over legacy assets that flow from contracts executed prior to October 1, 2007. The most significant of these legacy assets are the ISS and the Shuttle. For several years, audits of these legacy assets have identified serious weaknesses in internal controls over the

completeness and accuracy of the value of the assets. As a result, Agency management and E&Y have been unable to obtain sufficient evidentiary support for the amounts presented in the financial statements.

On October 14, 2009, the Federal Accounting Standards Advisory Board issued an accounting standard clarifying that reasonable estimates of historical cost may be used to value general PP&E. The standard clarifies that Federal entities should report their general PP&E based on historical cost in accordance with the asset recognition and measurement provisions of the earlier property accounting standards. However, the standard allows for reasonable estimates of historical cost to be used to value general PP&E assets. The proper and effective implementation of the new accounting standard will be important in remediating this deficiency regarding legacy capital assets.

In preparation for the issuance of the new accounting standard, NASA performed an analysis of costs that were capitalized for major components of the ISS and Shuttle. NASA undertook a similar effort when it changed its accounting policy for PP&E in FY 2007 and reclassified almost \$13 billion of costs previously categorized as general PP&E to research and development costs.

During its analysis in FY 2009, NASA changed its capitalization policy for Integration and Operations costs associated with the ISS after it was placed into service on September 30, 2001. NASA also changed its policy for capitalizing Shuttle launch service costs associated with the ISS. These policy changes resulted in the reclassification of approximately \$11 billion of ISS costs that were previously capitalized. Many of the adjustments affected prior periods and are recorded as a correction of an error in the financial statements.

Due to the volatility of the property balances and the increased risk of recording estimates for property, PP&E remains a significant management challenge. Ongoing efforts by NASA management to develop a robust and rigorous review process that both validates and challenges the adequacy of estimation techniques used and the sufficiency of documentation supporting those conclusions will serve NASA management well in preparing for the audit of these estimates in the future.

Environmental Liability Estimation. Over the past several years, NASA has taken proactive measures to improve its financial statement preparation processes and oversight. As a result, this issue is no longer reported as a material weakness for FY 2009; however, NASA has challenges estimating its unfunded environmental liability (UEL). These challenges include establishing an Agency-wide policy and ensuring consistent implementation of the policy across the Agency.

During FY 2009, NASA changed the timeframe it uses to estimate its environmental liability to clean-up contaminated sites. NASA now limits the length of the remediation period included in the UEL accrual estimates at 30 years as of the Balance Sheet date. According to NASA, beyond a 30-year horizon, UEL estimates have not proven to be reliable for presentation in the financial statements. While NASA's guidance regarding UEL estimates is under continued revision, NASA has articulated that reliable engineering estimates beyond the 30-year period will be taken into consideration while developing the accrual. However, no amounts in the FY 2009 accrual relate to periods past the 30-year horizon.

NASA developed a policy in September 2009 to capture cleanup costs for removing, containing, and/or disposing of hazardous waste from property or material associated with the permanent or temporary shutdown of a program. The Federal accounting standard that requires agencies to capture this information when applicable property is placed into service has been in effect since FY 1998; however, in September 2009, NASA made its first attempt to estimate and disclose those costs in the financial statements. In addition, E&Y found that NASA does not apply mark-ups (i.e., percentage increases applied to environmental liability estimates to account for contingencies) consistently to remediation projects from year to year, thus creating large variances in the UEL estimate when no other factors had changed. Generally, contingencies should not be changed from year to year unless there is appropriate justification. All of these issues contributed to NASA not having a stable and auditable UEL estimate.

Acquisition and Contracting Processes

One of NASA's long-standing management challenges relates to systemic weaknesses identified in its acquisition and contracting processes. GAO first identified NASA's contract management as a high-risk area in 1990, citing NASA's undisciplined cost-estimating processes in project development, the project managers' inability to obtain information needed to assess contract progress, and persistent cost growth and schedule slippage in the majority of its major projects. GAO noted improvements to NASA's processes in its most recent update to the high-risk areas, "High Risk Series: An Update" (GAO-09-271, January 2009), that included the development of a plan to address systemic weaknesses while noting that "it will take several years to fully implement these initiatives and transform the

agency into an organization that delivers the kind of analysis and forward-looking information needed to effectively manage its many complex programs.” During 2009, the OIG also noted NASA’s continued emphasis on monitoring this challenge and implementing disciplined acquisition management processes. However, both GAO and OIG audits and investigations continue to reveal systemic weaknesses in the areas of acquisition and procurement, to include awards as part of the Small Business Innovation Research (SBIR) Program.

Cost Estimates. In recent reviews of selected NASA programs, the OIG found that NASA still lacks the disciplined cost-estimating processes and financial and performance management systems needed to establish priorities, quantify risks, and manage program costs. Our review of the Stratospheric Observatory for Infrared Astronomy Program found that initial cost estimates were inaccurate and continuously increased as the Program progressed, and our review of the FY 2008 budget request for the Constellation Program found that cost estimates could have been better documented. Given that NASA programs and projects have historically experienced cost overruns, improvements in cost estimating with detailed, empirical data that explain the rationale for decisions could help minimize the risk of cost overruns by providing additional assurance that budget requests are adequate to achieve program and project goals.

GAO has also reported that NASA faces disparate challenges in estimating the cost to retire the Space Shuttle and transition to the Constellation Program. Although NASA continues to budget and manage the launch schedule to retire the Shuttle in 2010, it has yet to decide which facilities and equipment will transition to the Constellation Program and which will be sold, demolished, or preserved for historic value. Proper estimation of the cost to transition and dispose of its facilities and assets are critical to the long-term financial planning for the Constellation Program. According to GAO, NASA will need to determine the status of as many as 654 facilities, worth an estimated \$5.7 billion, and equipment estimated at \$12 billion. NASA continues to focus its efforts to address these challenges on providing improved estimates of transition costs.

Acquisition Process. GAO and OIG audits have continued to report systemic weaknesses involving NASA’s acquisition process. This year there were bid protests involving significant NASA programs pertaining to missteps in the NASA acquisition process. The bid protests cost the Agency in many ways—through delaying the furtherance of the mission for which the contract was being let, through costs generated by the bid protest process itself, and through the costs associated with maintaining the operational status quo. Given that NASA spends approximately 90 percent of its budget on contracts and awards, these systemic weaknesses pose significant challenges to NASA’s ability to make informed investment decisions. In response to this challenge, NASA revised its acquisition policy in 2007, which was a positive step in improving NASA’s ability to complete its programs and projects within cost, schedule, and performance parameters. However, implementation of the revised policy has created its own challenges by fundamentally changing NASA’s approach to acquisition.

In June 2007, the OIG initiated an audit of the Orion Project because it was one of the first space flight projects to implement the revised program and project management policy, which requires space flight projects to conduct life-cycle reviews during each phase of the project’s life cycle. These reviews are considered essential elements of conducting, managing, evaluating, and approving space flight projects. However, during our audit of the Orion Project, we found that NASA conducted a life-cycle review with a vehicle configuration that was not at the proper maturity level to proceed to the next phase. As a result, a significant portion of the vehicle configuration that eventually did proceed to the next phase had not been completely evaluated for compliance with requirements, which increased the risk of costly rework and schedule delays.

More than 3 years ago, GAO testified that NASA’s acquisition strategy of awarding a long-term contract for the design, development, production, and sustainment of Orion before developing a sound business case placed the project at risk of significant cost overruns, schedule delays, and performance shortfalls. Later, in October 2007, GAO noted that gaps in the Ares I Project included inadequate knowledge of requirements, costs, schedule, technology, design, and production feasibility. GAO also noted that, given the complexity and interdependence within the Constellation Program, these challenges were significant. In April 2008, GAO again testified that while NASA was working toward a preliminary design review for Ares I and Orion, there were considerable unknowns as to whether NASA’s plans could be executed within schedule and cost parameters because NASA was still in the process of defining many performance requirements. Most recently, GAO stated that Constellation Program cost and schedule uncertainties persist because “NASA is still struggling to develop a solid business case—including firm requirements, mature technologies, a knowledge-based acquisition strategy, a realistic cost estimate, and sufficient funding and time—needed to justify moving the Constellation program forward into the implementation phase.” The persistence

of this identified systemic weakness in NASA's most valuable program warrants scrutiny and immediate action to ensure the achievement of strategic goals.

Contract Management. With approximately 90 percent of NASA's annual budget used for procuring material and services via contracts and grants, careful attention to the proper administration and monitoring of these vehicles is in the best interest of NASA and the taxpayer. Over the past year, the OIG focused considerable effort in this area and noted several weaknesses.

One of GAO's criticisms of NASA's contract management is the Agency's inability to control cost. The NASA supplement to the Federal Acquisition Regulation (FAR) contains specific provisions to monitor contractor's cost control performance. However, OIG found that NASA project managers deemphasized the importance of controlling costs, minimized the effectiveness of cost control, and gave the contractors minimal incentives to control costs. Specifically, NASA managers did not include cost control measures weighted at no less than 25 percent of the total weighted award evaluation factors. This resulted in the unsupported payment of award fees of \$16 million and 27 months of contract term extensions, valued at \$3.375 billion in one contract and \$233,600 on another, that were not in compliance with the regulation.

GAO has also questioned the effectiveness of award fee type contracts, which are intended to inspire better contractor performance but require significant oversight and documentation to justify the award. We found several instances in which a lack of oversight and documentation resulted in questionable awarding of these fees. Specifically, in one instance we found that performance evaluation factors used to assess a contractor's performance were not sufficiently specific, did not provide the basis for a fair and objective assessment of the contractor's performance, and provided little evidence that the approximately \$2.2 million in award fees were fully justified or an accurate reflection of the contractor's performance. Similarly, in another instance, not only did we question the appropriateness of the award fee type contract but because the Agency's performance evaluations were incomplete and did not comply with guidance, NASA's overall assessment of the contractor performance may have been overstated.

As a result of GAO and OIG findings and recommendations, the Office of Procurement has made several changes to help improve the management of contracts. Specifically, the NASA supplement to the FAR has been revised to require documentation of a cost benefit analysis to support the use of award fees, the management of award fee contracts is being reviewed during the Procurement Management Reviews at each Center, and award fee ratings on selected programs and projects are reviewed during the monthly Baseline Performance Review. OIG will continue to monitor these efforts and evaluate their effectiveness in future work.

Small Business Innovation Research Program. OIG work has identified instances of fraud, waste, and abuse by Program participants that bring into question the effectiveness of the Program's internal controls. Specifically, of the 46 SBIR investigations we closed since 2001, eight (17 percent) have resulted in criminal convictions, civil judgments, or administrative corrective action. Our investigative and audit work has shown that some SBIR contractors received awards from multiple agencies for essentially the same work, submitted different proposals to multiple agencies but then provided all of them the same deliverable, or misrepresented information including the role of a principal investigator who was supposed to perform the research. In addition to initiating a comprehensive audit of NASA's management of the SBIR Program that will focus specifically on assessing the adequacy and implementation of the Program's internal controls, the OIG recommended that

- the Agency consider whether the SBIR program represents a weakness in internal controls that warrant monitoring as part of the Agency's implementation of OMB Circular A-123, "Management's Responsibility for Internal Control";
- the Director, Innovative Partnerships Program, take into consideration the OIG's past audit and investigative work concerning the SBIR Program when conducting the Statement of Assurance Process for 2009; and
- the Senior Assessment Team discuss NASA's SBIR Program and consider whether the Program's internal controls represent a vulnerability that should be monitored.

NASA is taking action to address these recommendations.

Standards of Ethical Conduct Compliance. There is a great deal of interaction between NASA and the private sector, including both industry and academia. Again, given that approximately 90 percent of NASA's budget is dedicated to contracts and grants, there is great incentive for private sector interests to influence NASA employees. There is also substantial interaction between NASA's scientists and researchers and those working for non-governmental entities, and incentives abound for such acts as sharing information that is sensitive but unclassified.

Many NASA employees often seek to pursue financial opportunities in the private sector beyond their Government employment. With the interchange of talented personnel between the public and private sectors, the advent of term appointments, the use of Intergovernmental Personnel Act appointments, and the use of contractors to meet personnel needs, management is challenged to ensure that ethics laws and regulations applicable to each category are identified and followed. It is imperative that NASA employees, as stewards of NASA's mission and budget, are aware of and comply with the applicable ethics laws and regulations.

We believe that the Agency's commitment to ethics is crucial to maintaining the confidence of Congress and the taxpayer so that NASA can fulfill its mission to further science and technology and to explore the universe. NASA needs to meticulously scrutinize its processes for appointments to panels, boards, and committees that are charged with rendering independent evaluations of NASA programs and projects. The consequences of not having a strong commitment to ethics or of having a workforce that does not embrace a culture of ethical compliance not only undermines the public's trust in Government but inherently causes a further disruption in Agency programs, given the host of consequential activities such as bid protests, contract cancellations, and inquiries by the investigative arms of Congress and the OIG.

Following our April 2008 audit related to the establishment of the Orion Project's Standing Review Board (SRB), which found that 6 of the Orion SRB's 19 members were not fully independent of the Orion Project, we initiated a review of all Constellation Program SRBs to determine whether similar issues existed with their SRBs. Similarly, we found 21 SRB members—close to one third of all non-Federal Constellation Program SRB members—with conflicts of interest and determined that each of the SRBs for Constellation Program included at least one non-Federal Government employee who was conflicted. Specifically, each SRB included at least one non-Federal Government employee who was an employee or consultant of a NASA contractor with an interest in or contract with either Constellation Program or one of its projects. This condition occurred because NASA's procedures for determining the independence of an SRB member were inadequate. Specifically, because the SRBs met the definition of Federal Advisory Committee Act (FACA)¹³ committees but were not organized under FACA, they did not trigger the ethics review process associated with the establishment of FACA committees. Instead, NASA used a process that was lacking in both rigor and accuracy for determining independence of SRB members.

We do note the Office of the General Counsel's commitment to ethics compliance and awareness, as the Office expanded its resources in the past 3 years to focus on acquisition integrity. Nevertheless, ethics issues, for the Agency as a whole, still accounted for a significant number of cases and allegations examined by the OIG in recent fiscal years. Several of those investigations caused protracted procurements, some also led to criminal convictions of NASA employees. For example:

- A former Chief of Staff was convicted on Conflict of Interest and False Statement charges stemming from the steering of earmarked funds to a client of his private consulting company.
- An SBIR contractor submitted false financial reports and included family members on the company payroll.
- An Intergovernmental Personnel Act employee overcharged NASA for payroll and fringe benefit costs.
- A NASA scientist steered contracts to a company operated by his spouse.
- Source Evaluation Board information was leaked to a potential contractor during a bid protest.
- Employees were guilty of organizational conflicts of interest and unauthorized access to proprietary information.
- A former NASA employee used information gained from his position at NASA to give an unfair advantage to a prospective contractor.

Although many of the examples are still under investigation, and may not be violations of applicable laws or regulations, they are emblematic of the types of allegations that arise with a technical workforce that works closely with the private sector to accomplish NASA's mission.

The OIG continues to work with Agency ethics officials to identify and address these issues through both training and enforcement; prudence would dictate that the Agency continue to examine the effectiveness of its ethics training and processes, given the continued number of ethics allegations and instances identified.

¹³Title 5, United States Code Appendix, Sections 1–16, the Federal Advisory Committee Act (1972), as amended.

Information Technology (IT) Security

Although our focus is on NASA's need to strengthen its IT security program, we recognize that achieving this goal will occur through improvements in the Agency's overarching IT management practices. In the past, NASA has reported IT security as a material weakness in the Administrator's annual Statement of Assurance. Since then, NASA has implemented various solutions in an attempt to improve its IT security. These solutions have resulted in continued incremental improvements across NASA's IT infrastructure; however, challenges remain. Specifically, not all solutions have been fully implemented and ongoing breaches of NASA computer systems have resulted in the theft of sensitive data related to Agency programs, which adversely affected NASA's mission and resulted in millions of dollars in losses.

During FYs 2008 and 2009, the Agency reported taking steps to prevent future breaches of its computer systems by making progress on two key management initiatives related to IT security. First, NASA implemented the Cyber Threat Analysis Program to proactively detect and handle intrusions into NASA's cyber assets. The program includes threat analysis, identification, and reporting as well as advanced data forensics methods. Second, NASA initiated the Security Operations Center (SOC) project to consolidate Agency security operations and incident response capabilities. The SOC is expected to be fully operational in late FY 2010 and will provide the Agency with end-to-end visibility and real-time monitoring of its computer networks and systems. In addition, the Agency also reported making significant progress implementing corrective actions related to IT security weaknesses as well as meeting its annual requirements under the Federal Information Security Management Act (FISMA).

In 2008, the Office of the Chief Information Officer (OCIO) concluded that IT security no longer needed to be reported as a material weakness in the Administrator's annual Statement of Assurance, provided certain conditions were met. These conditions included substantiated progress implementing corrective actions related to IT security weaknesses, full implementation of the SOC, and favorable results from regular security compliance reviews. The OIG performed a limited review to independently assess NASA's actions. We found that NASA had closed 91 percent of the OIG recommendations to improve IT security in FYs 2005 through 2007, established the Cyber Threat Awareness Program, completed implementation planning for the SOC, and improved compliance with FISMA requirements for its systems to be certified and accredited. Based on our limited review, we agreed with the conclusion of the OCIO that IT security should no longer be reported as a material weakness. However, the threat to NASA's computer networks and systems is tangible and evolving—both in scope and sophistication. As such, much work remains to be done in order for NASA to fully implement a sufficient and reliable IT security program.

For example, we identified an issue during our FY 2008 FISMA audit concerning the reporting of NASA's national security systems. Each year, OMB provides a FISMA reporting template for agencies to use in their annual FISMA reporting. The issue we identified related to information the Agency included in its responses to OMB regarding its national security systems. The subsequent OIG audit found that NASA did not comply with FISMA requirements for the reporting of national security systems for FYs 2007 and 2008 because NASA had not clearly assigned this responsibility to a specific NASA office. Further, NASA had not formally designated an entity with appropriate resources to complete the annual independent evaluations of its national security systems required by FISMA.

As part of our FY 2009 FISMA audit, we reviewed system certification and accreditation packages, security control tests, and contingency plan tests for 24 Agency and 5 external systems.¹⁴ Our review sample included systems from all NASA Centers, NASA Headquarters, and the NASA Shared Services Center. We found that 89 percent of the 29 systems that we reviewed were certified and accredited. However, only 25 percent had security controls tested within the last year and only 50 percent met annual FISMA requirements for contingency plan testing. NASA also could not provide evidence of required contractor oversight for four of the five external systems in our sample. In addition, we found that only 2 percent of the plans of action and milestones (POA&Ms) related to the 29 systems reviewed addressed IT security weaknesses. Finally, results from a concurrent GAO audit of NASA's IT security program identified 129 weaknesses in controls that are intended to restrict access to NASA's data and systems.

The significance of the reported IT security weaknesses is brought into clearer focus when taken into account along with the burgeoning network-centric threats that NASA faces. NASA continues to undergo successful attacks as cyber attack technology, new phishing techniques, and spyware programs become more damaging with the advancement of technology. For example, in December 2008, three systems with regular access to a NASA Center's

¹⁴NASA Standard Operating Procedure, ITS-SOP-0033, "External System Identification and IT Security Requirements," July 19, 2007, defines an external system as an IT system used by NASA to store or process "NASA information that is critical to the mission or operations of NASA. . . . External systems are generally owned by outside agencies, contractors, universities, or other organizations and provide services to other customers besides NASA."

badging database were compromised. NASA was unable to determine whether the incidents resulted in the theft of personally identifiable information from the database because of a lack of data regarding the incident. However, the lack of adequate safeguards potentially exposed a significant number of employees of that Center to identity theft. In a separate incident at the same Center, intruders were able to steal large amounts of research data that included information protected under the International Traffic in Arms Regulations. The Center's lack of adequate access controls allowed the intruders accesses to a great deal of data across a number of programs. Although only one legitimate user's account had been compromised initially, poorly implemented access controls allowed the intruders to achieve much greater success than they would have realized in a more controlled network environment. NASA's efforts to improve its IT security and management should decrease the likelihood of similar incidents in the future.

Although the ongoing development and implementation of both the Cyber Threat Analysis Program and the SOC are representative of the Agency's progress, the Agency is still developing and implementing various other projects involving incident management. For example, the implementation of the SOC is still incomplete. Additional time will also be required to demonstrate the effectiveness of this program.

Improper Payments Information Act (IPIA) Assessment

Improper Payment Compliance

The National Aeronautics and Space Administration (NASA) is dedicated to reducing fraud, waste, and abuse by adequately reviewing and reporting programs susceptible to improper payments in accordance with the Office of Management and Budget (OMB) Circular A-123 *Management's Responsibility for Internal Control*, Appendix C, *Requirements for Effective Measurement and Remediation of Improper Payments*. To improve the integrity of the Federal government's payments and the efficiency of its programs and activities, Congress enacted the Improper Payments Information Act (IPIA) of 2002 (Public Law No. 107-300). The IPIA contains requirements in the areas of improper payment identification and reporting. It requires agency heads to annually review all programs and activities, identify those that may be susceptible to significant improper payments, estimate annual improper payments in susceptible programs and activities, and report the results of their improper payment activities.

In August 2006, OMB issued Appendix C of OMB Circular A-123—*Requirements for Effective Measurement and Remediation of Improper Payments*. Appendix C supersedes OMB's previous promulgations on improper payments and requires all Executive branch agencies to:

- **Review all of its programs and activities to identify those susceptible to significant improper payments. OMB defines significant improper payments as those in any particular program or activity that exceed both 2.5 percent of program payments and \$10 million annually.**
- **Obtain a statistically valid estimate of the annual amount of improper payments in programs and activities.**
- **Develop corrective action plans and reduction targets for programs and activities found to be susceptible to significant improper payments.**
- **Include, in the Performance and Accountability Report (PAR), an estimate of the annual amount of improper payments in programs and activities and the progress in reducing them.**

The IPIA defines an improper payment as any payment that should not have been made or that was made in an incorrect amount (including overpayments and underpayments) under statutory, contractual, administrative, or other legally applicable requirements.

NASA's IPIA assessment in fiscal years 2004 through 2008 resulted in improper payments less than 2.5 percent of program payments and less than \$10 million. With the assistance of contractor support, during fiscal year (FY) 2009, NASA continued its efforts to improve the integrity of its payments and the efficiency of its programs by conducting a risk assessment of its programs and activities. NASA identified the following eight programs as susceptible to improper payments:

- **Constellation Systems**
- **Cosmic Origins**
- **Earth Science Research**
- **Earth Systematic Missions**
- **Institutions and Management**
- **International Space Station**
- **Mars Exploration**
- **Space Shuttle Program**

Total payments related to these programs amounted to approximately \$5 billion in FY 2008. During FY 2009, with the assistance of contractor support, NASA performed an improper payment review of each program in accordance with Appendix C of OMB Circular A-123 and identified an estimated total of approximately \$822,359 in improper payments with a percentage estimate of 0.0197%. This annual estimate was based on NASA's FY 2008 data (October 1, 2007 to September 30, 2008). Although the testing performed found that the programs did not have significant improper payments, as defined by OMB A-123, Appendix C, NASA will continue to measure and report the annual amount of improper payments.

Improper Payments Information Act Reporting Details

The Improper Payments Information Act (IPIA) of 2002 requires Federal agencies to review their programs and activities annually to identify those programs that are susceptible to significant improper payments. The Office of Management and Budget (OMB) guidance defines significant improper payments as annual improper payments in a Line of Business or Program that exceed both 2.5 percent of program payments and \$10 million. Agencies are required to identify any programs and activities with significant improper payments, report the annual amount of improper payments, and implement corrective actions.

I. Risk Assessment

NASA's risk assessment for FY 2009 was developed using criteria established for determining levels of risk and evaluating all major programs against these criteria. Risk factors included conditions related to financial processing and internal controls, internal and external monitoring and assessments, human capital risk, programmatic risk, and the nature of programs and payments.

In FY 2009, NASA performed a comprehensive qualitative and quantitative risk assessment. NASA's risk assessment was conducted to identify those programs susceptible to significant improper payments. NASA used the following four-step methodology to update its risk assessment.

(1) Determine Scope of Programs Subject to Risk Assessment

NASA began its risk assessment by determining the population and scope of programs which would be subject to review. NASA derived its initial program scope based upon the FY 2008 total disbursements, and identified 84 distinct programs. NASA generated disbursement totals for each program from its financial management system. The aggregate disbursement total was validated against NASA's SF-133, *Report on Budget Execution and Budgetary Resources*. The number of in-scope programs was then reduced to 33 based on the materiality of disbursements.

(2) Develop Risk Matrix Elements

Once the scope of the risk assessment was finalized, NASA developed a web-based questionnaire to assist in the implementation of the assessment. The web-based questionnaire was designed to accurately capture and represent the relevant risk conditions facing NASA's programs, and measure the significance of those risk conditions for each program. The web-based questionnaire included risk conditions upon which NASA's programs would be evaluated and captured data such as risk assessment scores, disbursement values, and estimated error rates.

(3) Evaluate Risk Condition of In-scope Programs

NASA evaluated the risk condition of in-scope programs including factors such as the control environment, internal and external monitoring, human capital risk, programmatic risk, and the nature of program payments. Additionally, NASA compiled the results of a Risk Assessment web-based questionnaire that was completed by Senior Management and Program Personnel.

(4) Populate Risk Matrix and Identify Highly Susceptible Programs

Based on the results of the web-based questionnaire, interviews with process owners and review of several NASA Financial management reports such as the Independent Auditor's report, NASA populated the risk matrix with qualitative data for each program (and risk condition). The qualitative data was used in conjunction with the scoring criteria to assign a risk score to each risk condition. NASA used the risk condition scores and weighting formulas to determine an overall risk score, and identify programs susceptible to significant improper payments. As a result the following programs were identified:

- **Constellation Systems**
- **Cosmic Origins**

- **Earth Science Research**
- **Earth Systematic Missions**
- **Institutions and Management**
- **International Space Station**
- **Mars Exploration**
- **Space Shuttle Program**

Due to the results of the FY 2007 and FY 2008 improper payments assessments, four of the programs identified during the FY 2009 risk assessment were determined as not susceptible to improper payments. These programs were:

- **Institutions and Management**
- **International Space Station**
- **Mars Exploration**
- **Space Shuttle Program**

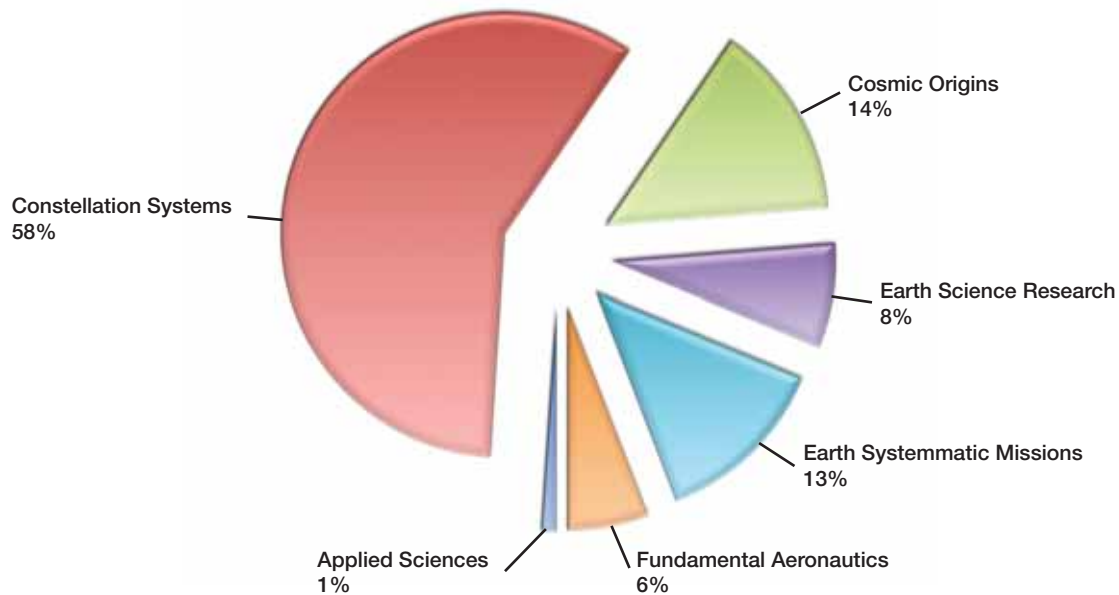
The Office of the Chief Financial Officer (OCFO) Quality Assurance Division (QAD) decided to not include the low risk programs in an effort to assess programs not previously reviewed during FY 2007 or FY 2008. Additionally, it was concluded that programs assessed and tested during the two previous years and rated low risk would establish the three year baseline for the NASA risk assessment and improper payment program.

Because only four programs were selected for testing, NASA took this opportunity to capitalize on its conservative approach by evaluating other programs for testing that would be receiving new funding as a result of the American Recovery and Reinvestment Act of 2009 (ARRA). As such, in order to identify additional relevant programs to include in the testing phase of the assessment, QAD considered the original scope of the FY 2009 risk assessment. Implementing a “hands-on” approach, QAD and Grant Thornton proceeded to identify those programs that would be recipients of ARRA funds. The rationale for this approach was to evaluate those programs receiving ARRA funds to determine if safeguards are in place to prevent significant improper payments. This approach would help QAD prevent future problems in regards to improper payments; ascertain potential payment issues; and place effective controls to mitigate issues in the years ahead.

The additional programs identified and added to the scope of the FY 2009 testing phase were:

- **Applied Sciences**
- **Fundamental Aeronautics**

**FY 2009 Programs Susceptible to High Risk of Significant Improper Payments,
As a Percentage of Total Susceptible Programs**



Detailed Amounts by Program

FY 2009 Susceptible Programs	Total Program Payments FY 2008
Applied Sciences	\$52,912,037.92
Constellation Systems	\$3,012,665,751.88
Cosmic Origins	\$734,769,036.40
Earth Science Research	\$387,129,675.96
Earth Systematic Missions	\$664,003,048.16
Fundamental Aeronautics	\$302,334,749.42
Total	\$5,153,814,299.74

II. Statistical Sampling

For each program identified as being susceptible to significant improper payments, NASA developed a statistically valid random sample of program payments in accordance with OMB guidelines and conducted tests of transactions in order to determine whether payments were proper or improper. NASA used a statistical random sampling method to yield an estimate with a 90 percent confidence level of plus or minus 2.5 percent for each program. A total number of 2,183 transactions were selected and investigated for the period of October 1, 2007 to September 30, 2008. The types of transactions included vendor payments, Government purchase card, and travel expenditures.

Description of Population and Sample Data

A random sample was selected for the period for each of the six programs identified as susceptible to significant improper payments. The following table shows the number of transactions and dollar value by program for the payment population and sample:

Number of Transactions and Dollar Value by Program

Program	Transactions		\$ Value	
	Population	Sample	Population	Sample
Applied Sciences	6,028	361	\$30,578,234.68	\$36,100,258.55
Constellation Systems	92,434	581	2,473,863,563.85	344,396,416.41
Cosmic Origins	23,494	269	679,310,000.78	663,746,161.38
Earth Science Research	20,233	250	592,217,208.97	66,458,558.50
Earth Systemmatic Missions	40,119	286	232,188,007.54	280,501,443.77
Fundamental Aeronautics	42,480	436	167,326,383.41	52,768,718.98
Total	224,788	2,183	\$4,175,483,399.23	\$1,443,971,557.59

The sampling methodology and sample selection for each program is described below:

Sampling Methodology: A stratified sampling approach was applied to estimate improper payments for all payment types in the programs selected for sampling.

Sample Selection: The population of payments included vendor payments, Government purchase card transactions, and travel expenditures in the defined testing period. A total of 2,183 items were selected and tested for the FY 2009 sample.

III. Conclusion

Based on the results of testing, NASA identified two improper payments for a gross total of \$254. An extrapolation of the two payments over the entire universe resulted in \$822,359 of estimated improper payments with an estimate percentage of 0.0197% during the period (October 1, 2007–September 30, 2008). These amounts are not considered significant as defined by OMB A-123, Appendix C and therefore NASA is not required to submit a written corrective action plan; however, NASA will implement corrective actions in FY 2010 to further reduce its exposure to improper payments.

The following table shows the total payments by population, sample amount, and annual estimate of improper payments by program.

FY 2009 Total Improper Payments by Program

Program	Dollars		FY 2009 Annual Estimate of Improper Payments		FY 2009 Estimate of Improper Payments
	Population	Sample			
Applied Sciences	\$ 30,578,235	\$ 36,100,259	0.3047%	\$	93,178
Constellation Systems	2,473,863,564	344,396,416	0.0000%		–
Cosmic Origins	679,310,001	663,746,161	0.1073%		729,181
Earth Science Research	592,217,209	66,458,559	0.0000%		–
Earth Systemmatic Missions	232,188,008	280,501,444	0.0000%		
Fundamental Aeronautics	167,326,383	52,768,719	0.0000%		–
Total	\$ 4,175,483,400	\$ 1,443,971,558	0.0197%	\$	822,359

NASA identified the following type of improper payments:

Contract payments to vendors were paid after the due date—as defined by the Prompt Payment Final Rule —5 CFR 1315 in the Code of Federal Regulations. As a result, an interest penalty should have been applied to the vendor payment. The Prompt Payment Final Rule requires Executive departments and agencies to pay commercial obligations within certain time periods and to pay interest penalties when payments are late. These payments constituted underpayments. Specifically, the Applied Sciences transaction was two days late. Grant Thornton applied a 5.125% interest rate per Prompt Pay Interest Rate History Chart (fms.treas.gov/prompt/rates.html) to the transaction total (\$25,778) for an underpayment total of \$7. The Cosmic Origins transaction was three days late. Grant Thornton applied a 5.75% interest rate per Prompt Pay Interest History Chart to the transaction total (\$515,701) for an underpayment total of \$247. The total underpayment for the two transactions totaled \$254.

Recovery Audit

In accordance with the requirements of section 831 of the *Defense Authorization Act* of FY 2002, NASA performs recovery audits as part of its overall program of effective internal control over contract payments. In FY 2009 NASA performed a recovery audit focused on its FY 2007 disbursements.

In accordance with OMB guidance, agencies may determine to exclude classes of contracts and contract payments from recovery audit activities if the agency head determines that the recovery audits are inappropriate or not a cost-effective method for identifying and recovering improper payments. Consequently NASA does not include cost-type contracts in its assessment for recovery audits.

Last year NASA engaged an industry leader in recovery auditing under a contingency contract and FY 2006 disbursements were audited. This year, FY 2007 disbursements were audited and the results are listed in the following table. The Recovery Audit of FY 2008 disbursements currently is underway.

Agency Component	Amount Subject to Review for FY 2007 Reporting	Actual Amount Reviewed and Reported FY 2007	Amounts Identified for Recovery FY 2007	Amounts Recovered FY 2007	Amounts Identified for Recovery Prior Years (PYs)	Amounts Recovered (PYs)	Cumulative Amounts Identified for Recovery (CY + PYs)	Cumulative Amounts Recovered (CY + PYs)
NASA	\$4,740,930,555	\$4,740,930,555	\$1,714	\$1,714	\$207,838	\$204,567	\$209,552	\$206,281

The Agency has taken steps through the Improper Payment reviews and recovery audits to continue holding agency managers accountable for reducing and recovering improper payments. The Recovery Audit process is monitored by headquarters to ensure compliance with NASA's Recovery Audit Guidance. In addition, all collection and disbursement functions are now centralized at the NASA Shared Services Center which ensures not only prompt recovery of overpayments, but an effective way to control and review all contract payments.

NASA has the infrastructure and information technology in place to reduce improper payments. There are no statutory or regulatory barriers limiting NASA's ability to reduce improper payments.

FY 2009 Inspector General Act Amendments Report

Background

The *Inspector General Act* of 1978 (P.L. 95-452) requires that the head of each Federal agency make a final management decision on all audit recommendations issued by the Office of Inspector General (OIG) within a maximum of six months after the issuance of an audit report. The Act further requires that the head of each Federal agency attain final management action on each final management decision within 12 months after issuance of an audit report.

The *Inspector General Act Amendments* of 1988 (P.L. 100-504) added a requirement that the head of each Federal agency report on the status of final management decisions and final management action taken on OIG audit recommendations, as well as on the monetary benefits identified in those audit reports. Specifically, agency heads are required to report:

- The number of OIG audit recommendation for which a final management decision has not been made within six months after the date of a final audit report;
- The number of OIG audit recommendations for which final management action has not been achieved within 12 months after the date of a final report, and;
- The dollar amount of monetary benefits identified (i.e., disallowed costs and funds to be put to better use [FPTBU])

The following definitions are provided to enhance the readability of NASA's FY 2009 Inspector General Act Amendments Report:

A **Final Management Decision** (also referred to as resolution) occurs when an agreement is reached between Agency and OIG as to course of action to be taken with respect to an audit recommendation made by the OIG (or a contractor performing audit services for the OIG).

Final Management Action is the point in time when corrective action, taken by management in conjunction with a final management decision, is completed.

Corrective Action consists of remediation efforts on the part of management which are intended to mitigate an audit finding.

Questioned Costs identified by the auditors' result from an initial finding that incurred costs are either: a) not consistent with a provision of a law, regulation, contract, grant, cooperative agreement, or other agreement or document governing the expenditure of funds; (b) a finding that, at the time of the audit, such cost is not supported by adequate documentation; or (c) a finding that the expenditure of funds for the intended purpose is unnecessary or unreasonable.

Disallowed Costs are questioned costs that management has determined should not be charged to the Government.

Funds to be Put to Better Use (FPTBU) are funds that could be used more efficiently if management implemented audit recommendations. Efficiencies may result from: reductions in outlays; de-obligation of funds, or; costs not incurred by implementing recommended improvements related to operations of the agency, a contractor, or a grantee.

NASA's Audit Follow-up Program

NASA management is committed to ensuring the timely resolution of audit recommendations, coupled with the timely implementation and completion of related corrective actions. NASA management also believes that audit follow-up is essential to improving the efficiency and effectiveness of NASA programs, projects, and operations. In

this regard, NASA has implemented a comprehensive program of audit liaison, resolution, and follow-up (ALRFU) intended to ensure that OIG audit recommendations are resolved and corrective action is implemented and completed in a timely and effective manner.

NASA's Office of Internal Controls and Management Systems (OICMS) is responsible for policy formulation, oversight, and functional leadership of NASA's ALRFU program. OICMS operates in conjunction with a network of Audit Liaison Representatives (ALRs) imbedded within each of NASA's Mission Directorates, Mission Support Offices, Administrator's staff offices, and field Centers. This virtual team collectively provides the organizational structure to support NASA's ALRFU program.

In FY 2006, OICMS implemented the periodic assessment of the efficiency and effectiveness of NASA's audit follow-up program, based on requirements delineated in Office of Management and Budget Circular A-50, *Audit Follow-up*, dated September 29, 1982. These "Post-Closure Follow-up Reviews" (PCFR) have been conducted during FY 2006, FY 2007 and FY 2009. In general, the results have indicated that NASA's ALRFU results in the efficient, prompt, and proper resolution and corrective action on audit recommendations issued by the NASA OIG.

FY 2009 Audit Follow-up Results

1. Final Management Decision Pending—More than Six Months After Report Issuance

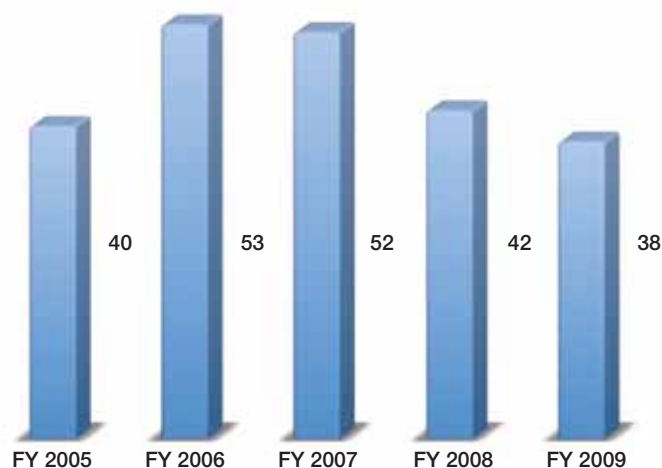
For the fiscal year ended September 30, 2009, there were no OIG audit recommendations pending a final management decision more than six months after the issuance of the associated audit reports.

2. Final Management Action Pending—One Year or More After Report Issuance

As of September 30, 2009, there were 18 OIG audit reports containing at total of 38 recommendations on which a final management decision had been made but final management action was still pending, one year or more after the issuance of the respective reports (see Table 1).

For comparative purposes, as of September 30, 2008, there were 17 audit reports containing 42 recommendations on which a final management decision had been made, but final management action was still pending one year or more after the issuance of the respective reports. For the five year period ended September 30, 2009, the number of OIG audit recommendations pending final management action one year or more after issuance of a final audit report ranged between 38 and 53. With the exception of two outlier years (FYs 2006 and 2007), the number of these audit recommendations has remained relatively static and have ranged between 38 and 42 (see Figure 1).

Figure 1: The Number of OIG Audit Recommendations Open More Than One Year



Frequently, the corrective action associated with a final management decision spans several reporting periods. This may be due to the complexity of the planned corrective action (which often times consists of the design, implementation, and testing of related systems or sub-systems); or the development, concurrence, and review process associated with NASA policy and/or procedural requirements. In spite of these constraints, NASA management continues to aggressively pursue the implementation of agreed-upon corrective action relating to audit recommendations issued by the OIG.

**Table 1: Summary of OIG Audit Reports Pending Final Management Action
One Year or More After Issuance of a Final Report
(As of September 30, 2009)**

Report No. Report Date	Report Title	No. of Recommendations	
		Open	Closed
IG04025 09-07-04	NASA's Implementation of the Mission Critical Space System Personnel Reliability Program	1	5
IG05016 05-12-05	NASA's Vulnerability Assessment Program	1	3
IG06007 03-21006	NASA's Implementation of Patch Management Software is Incomplete	1	1
IG07006 11-15-06	FY 2006 NASA Financial Statement Audit Report	1	18
IG07003 11-20-06	Governance of the Systems, Applications, and Products Version Update Project Needs Improvement	1	5
IG07005 01-30-07	NASA's Draft Plan for Space Shuttle Transition Could Be Improved by Following Project Management Guidelines	1	3
IG07014 06-19-07	Controls over the detection, response and reporting of network security incidents needed improvement at 4 NASA Centers reviewed	4	4
IG07013 07-24-07	MSFC's Approach to PDM and MCAD Software Tools as Standard Center-Wide	1	2
IG07029 09-18-07	Final Memorandum on Education and Training Grants	1	2
IG08001 11-15-07	Audit of NASA's Fiscal Year 2007 Financial Statements	3	24
IG08004 12-11-07	NASA's Accounting for Real Property Leased to Other Entities	4	0
IG08005 12-11-07	Final Memorandum on NASA's Accounting for Capitalized Real Property Designated as Inactive	4	0
IG08018 04-28-08	Final Memorandum on the Standing Review Board to the Orion Crew Exploration Vehicle Project	7	1
IG08014 05-09-08	Review of the National Aviation Operations Monitoring Service	1	2
IG08017 06-02-08	Actions Needed to Ensure Scientific and Technical Information is Adequately Reviewed at Goddard Space Flight Center, Johnson Space Center, Langley Research Center, and Marshall Space Flight Center	1	6
IG08021 07-08-08	Review of NASA's Plan to Build the A-3 Facility for Rocket Propulsion Testing	1	1
IG08027 09-04-08	Glenn Research Center Needs to Better Define Roles and Responsibilities for Emergency Response	1	5
IG08025 09-19-08	Kennedy Space Center's Security Program Needed Improvement	4	4
18	Totals	38	86

3. Audit Reports with Disallowed Costs and/or Funds to Be Put to Better Use

During FY 2009, the OIG issued four audit reports which identified monetary benefits totaling \$16,411,200. Monetary benefits pending management disposition carried over from FY 2008 totaled \$300,000. Total monetary benefits (disallowed costs and funds to be put to better use) dispositioned by management during FY 2009 totaled \$16,711,200. No monetary benefits were pending final management action as of September 30, 2009 (see Table 2).

Table 2: Summary of Disallowed Costs and Funds to Be Put to Better Use

(For the Year Ended September 30, 2009)

Category	Disallowed Costs		Funds to Be Put to Better Use	
	Number of Reports	Dollars	Number of Reports	Dollars
1. Reports pending final management action at the beginning of the reporting period	–	\$0	1	\$300,000
2. Plus: Reports on which management decisions were made during the reporting period	4	\$16,411,200	–	–
3. Total reports pending final action during the reporting period (1 + 2)	4	\$16,411,200	1	\$300,000
4. Reports on which final action was taken during the reporting period	4	\$16,411,200	1	\$300,000
5. Audit reports pending final action at the end of the reporting period (3-4)	–	\$0	–	\$0

Summary of Financial Statement Audit and Management Assurances

The following tables summarize the Agency's FY 2009 material weaknesses. Table 1 summarizes the material weaknesses identified by the Financial Statement Auditor in their report on Internal Control. Table 2 summarizes the material weaknesses identified by NASA Management in the Statement of Assurance included in the Management Assurance section of this PAR.

Table 1: Summary of Financial Statement Audit

Audit Opinion	Disclaimer				
Restatement	Yes				
Material Weaknesses	Beginning Balance	New	Resolved	Consolidated	Ending Balance
Controls Over Legacy Property, Plant and Equipment	1	0	0	0	1
Financial Systems, Analyses and Oversight	1	0	1	0	0
Total Material Weaknesses	2	0	1	0	1

Table 2: Summary of Management Assurances

Effectiveness of Internal Control Over Financial Reporting (FMFIA 2)						
Statement of Assurance	Qualified					
Material Weaknesses	Beginning Balance	New	Resolved	Consolidated	Reassessed	Ending Balance
Controls Over Legacy Property, Plant and Equipment	1	0	0	0	0	1
Financial Systems, Analyses, and Oversight	1	0	1	0	0	0
Total Material Weaknesses	2	0	1	0	0	1
Effectiveness of Internal Control Over Operations (FMFIA 2)						
Statement of Assurance	Unqualified					
Material Weaknesses	Beginning Balance	New	Resolved	Consolidated	Reassessed	Ending Balance
Total Material Weaknesses	0	0	0	0	0	0
Conformance With Financial Management System Requirements (FMFIA 4)						
Statement of Assurance	See section below on FFMIA Compliance.					
Material Weaknesses	Beginning Balance	New	Resolved	Consolidated	Reassessed	Ending Balance
Financial Systems, Analyses, and Oversight	1	0	1	0	0	0
Total Material Weaknesses	1	0	1	0	0	0
Compliance With Federal Financial Management Improvement Act (FFMIA)						
	Agency			Auditor		
Overall Substantial Compliance	No			No		
1. System Requirements met?				No		
2. Accounting Standards met?				No		
3. USSGL at Transaction Level met?				Yes		

Missions at a Glance

AIM is a two-year mission to study Polar Mesospheric Clouds (PMCs), Earth's highest clouds, which form an icy membrane 50 miles above Earth's surface at the edge of space. The primary goal of AIM is to explain why PMCs form and what causes changes in their behavior. www.nasa.gov/mission_pages/aim/index.html

Aqua is a major international Earth Science satellite mission. Launched on May 4, 2002, the satellite has six different Earth-observing instruments on board and is named for the mission's focus on water in the Earth system. Aqua collects approximately 89 gigabytes of data daily. www.nasa.gov/mission_pages/aqua/index.html

Aquarius is a focused satellite mission that measures global sea surface salinity. After its 2010 launch, it will provide a global view of salinity variability to enhance climate studies. NASA and the Space Agency of Argentina are currently developing the Aquarius. aquarius.gsfc.nasa.gov

Ares 1 is an in-line, two-stage rocket. NASA plans to use Ares I to launch Orion, the spacecraft intended to replace the Space Shuttle for NASA human spaceflight missions after the Shuttle's retirement in 2010. www.nasa.gov/mission_pages/constellation/ares/ares1/index.html

Aura was launched July 15, 2004, the Aura satellite studies Earth's ozone, air quality, and climate. www.nasa.gov/mission_pages/aura/main/index.html

CALIPSO uses a cloud profiling radar system to study the role that clouds and airborne particles play in regulating Earth's weather, climate, and air quality. CALIPSO combines an active lidar instrument with passive infrared and visible imagers to probe the structure and properties of thin clouds and aerosols over the globe. NASA launched CALIPSO on April 28, 2006 with the CloudSat satellite. http://www.nasa.gov/mission_pages/calipso/main/index.html

Cassini/Huygens was launched on a Titan IV rocket in October 1997, carrying NASA's Cassini orbiter and the European Space Agency's Huygens probe. The Cassini/Huygens' mission is providing data for a detailed study of Saturn, its rings, icy satellites, magnetosphere, and the environment of Titan. saturn.jpl.nasa.gov/index.cfm

Chandra X-ray Observatory, launched and deployed by Space Shuttle Columbia on July 23, 1999, is the most sophisticated X-ray observatory built to date. Since Earth's atmosphere absorbs the vast majority of X-rays, they are not detectable from Earth-based telescopes. Chandra will advance knowledge about the high-energy universe. nasascience.nasa.gov/missions/chandra

CINDI, launched on April 16, 2008, will study the elements that influence space weather near Earth's equator. www.nasa.gov/mission_pages/cindi/

CloudSat was launched with the CALIPSO satellite to study the role that clouds and aerosols play in regulating Earth's weather, climate and air quality. www.nasa.gov/mission_pages/cloudsat/mission/index.html

Cluster II, launched in July of 2000, is an investigation of Earth's magnetosphere using four identical spacecraft simultaneously. nasascience.nasa.gov/missions/cluster

COBE, launched on November 18, 1989, provided precise satellite measurements of cosmic radiation, which confirmed the Big Bang theory of the origin of the universe. nasascience.nasa.gov/missions/cobe

Constellation Program will create a new generation of spacecraft for human spaceflight, consisting primarily of the Ares I and Ares V launch vehicles, the Orion crew capsule, the Earth Departure Stage, and the Altair Lunar Lander. These spacecraft will be capable of performing a variety of missions, from International Space Station resupply to lunar landings. www.nasa.gov/mission_pages/constellation/main/index.html

Dawn will study the asteroid Vesta and dwarf planet Ceres, celestial bodies believed to have accreted early in the history of the solar system. The mission will characterize the early solar system and the processes that dominated its formation. Dawn launched in September of 2007. dawn.jpl.nasa.gov

EPOXI combines two exciting science investigations in a new mission that re-uses the Deep Impact spacecraft already in orbit around the Sun. The Extrasolar Planet Observation and Characterization (EPOC) investigation observed stars with giant planets, and the Deep Impact eXtended Investigation (DIXI) of comets will observe comet 103P/Hartley 2 during a close flyby in November 2010. www.nasa.gov/mission_pages/epoxi/index.html

GALEX is an orbiting space telescope that observes galaxies in ultraviolet light. Since its launch in 2003, the mission has surveyed tens of thousands of galaxies in ultraviolet light. The mission will reveal the history of star formation in the universe. nasascience.nasa.gov/missions/galex

Glory is a low Earth orbit scientific research spacecraft that collects data on Earth's atmosphere and climate system to determine if temperature increase and climate change are natural events or the effects of human influence. glory.gsfc.nasa.gov

GOES/POES is composed of two geostationary satellites and two polar orbiting satellites that operate in pairs to monitor the east and west coasts separately. They provide real-time weather data for short-term weather forecasting of severe weather, space environment monitoring, and research and development. The polar orbiting satellites provide global long-range weather forecasting, ensuring that non-visible data are no more than six hours old. goespoes.gsfc.nasa.gov/goes/index.html

GPM is one of the next generation of satellite-based Earth science missions that will study global precipitation such as rain, snow, and ice. nasascience.nasa.gov/missions/gpm

GRACE accurately maps variations in Earth's gravity field. GRACE launched on March 17, 2002, sending two identical spacecrafts into a polar orbit about 310 miles above the Earth. nasascience.nasa.gov/missions/grace

GRAIL is a dual satellite mission with high-quality gravity mapping capabilities that will be launched to the Moon to determine the structure of the lunar interior, from crust to core, and to advance understanding of the Moon's thermal evolution. nasascience.nasa.gov/missions/grail

Hayabusa, a Japanese mission launched in May 2009, will collect a surface sample of material from the small asteroid 25143 Itokawa and return the sample to Earth for analysis. It also is a technology demonstration mission. Other scientific objectives of the mission include detailed studies of the asteroid's shape, spin state, topography, color, composition, density, photometric and polarimetric properties, interior and history. neo.jpl.nasa.gov/missions/hayabusa.html

Hubble Space Telescope, launched on April 1990, is a large, space-based observatory which has revolutionized astronomy by providing unprecedented deep and clear views of the universe, ranging from our own solar system to extremely remote fledgling galaxies that began forming not long after the Big Bang 13.7 billion years ago. hubble.nasa.gov

IBEX, launched October 19, 2008, is a small satellite, about the size of a bus tire. IBEX is the first mission designed to map the entire region of the boundary of our Solar System while rotating Earth. nasascience.nasa.gov/missions/ibex

ICESat I, launched in February 2004, is the benchmark Earth Observing System mission for measuring ice sheet mass balance, cloud and aerosol heights, as well as land topography and vegetation characteristics. ICESat I has provided multi-year elevation data needed to determine ice sheet mass balance as well as cloud property information, especially for stratospheric clouds common over polar areas. Its mission will end in 2009, and it will be replaced by ICESat II, currently in formulation. icesat.gsfc.nasa.gov

International Space Station (ISS), which was begun in 1998 and will be completed by 2011. Scientists will continue daily research operations in its microgravity environment that spans several sciences, enhancing knowledge in the fields of biology, human biology, physics, astronomy, and meteorology. It also is a place to test space exploration technologies and capabilities. www.nasa.gov/mission_pages/station/main/index.html

IRAS, launched on January 25, 1983, was a joint project of the United States (NASA), the Netherlands (NIVR), and the United Kingdom (SERC) and was the first observatory to perform an all-sky survey at infrared wavelengths. lambda.gsfc.nasa.gov/product/iras/

Jason-1, launched on December 7, 2001, is an oceanography mission to monitor global ocean circulation, improve global climate predictions, and monitor events such as El Niño conditions and ocean eddies. sealevel.jpl.nasa.gov/mission/jason-1.html

Jason-2/OSTM, which launched June 20, 2008, follow the ocean surface topography measurements of TOPEX/Poseidon (T/P) and the Jason-1 mission, and extends the time series of observations to two decades. sealevel.jpl.nasa.gov/mission/ostm.html

JDEM, a planned mission of NASA and the U.S. Department of Energy, will be an observatory containing a telescope and appropriate focal plane instruments to investigate dark energy. nasascience.nasa.gov/missions/jdem

Juno will significantly improve understanding of the formation, evolution, and structure of Jupiter. It will answer critical science questions about Jupiter, as well as provide key information to dramatically enhance present theories about the early formation of the solar system. nasascience.nasa.gov/missions/juno

JWST is a large, infrared-optimized space telescope that will find the first galaxies that formed in the early universe. It will peer through dusty clouds to see stars forming planetary systems. nasascience.nasa.gov/missions/jwst

Kepler, launched on March 6, 2009, is surveying our region of the Milky Way galaxy to discover hundreds of Earth-size and smaller planets in or near the habitable zone and determine the fraction of the hundreds of billions of stars in our galaxy that might have such planets. www.nasa.gov/mission_pages/kepler/main/index.html

LADEE will orbit the Moon, characterizing the atmosphere and lunar dust environment. LADEE implements an early priority of the National Research Council's 2007 report, *The Scientific Context for the Exploration of the Moon*, namely to "determine the global density, composition, and time variability of the fragile lunar atmosphere before it is perturbed by further human activity." nasascience.nasa.gov/missions/ladee

LCROSS launched with LRO on June 18, 2009. The main LCROSS mission objective is to confirm the presence or absence of water ice in a permanently shadowed crater near a lunar polar region. www.nasa.gov/lcross/

LDCM follows the Landsat mission and provides continuous satellite acquisition of high-resolution multispectral data of Earth's surface on a global basis. The data from the Landsat spacecraft constitute the longest record of the Earth's continental surfaces as seen from space, unmatched in quality, detail, coverage, and value. ldcm.nasa.gov

LRO will spend at least one year in a low polar orbit approximately 31 miles above the lunar surface, while its seven instruments find safe landing sites, locate potential resources, characterize the radiation environment, and test new technology. www.nasa.gov/LRO

MAVEN will provide the first direct measurements ever taken to address key scientific questions about Mars' evolution: Mars once had a denser atmosphere that supported the presence of liquid water on the surface. As part of a dramatic climate change, most of the Martian atmosphere was lost. MAVEN will make definitive scientific measurements of present-day atmospheric loss that will offer clues about the planet's history. www.nasa.gov/mission_pages/mars/news/maven_20080915.html

MESSENGER, launched on August 3, 2004, is a scientific investigation of the planet Mercury, the least explored terrestrial planet. MESSENGER will be the second mission to visit Mercury, and the first to orbit the planet. nasascience.nasa.gov/missions/messenger

MMS is a Solar-Terrestrial Probe mission that will be comprised of four identically instrumented spacecraft. It will use Earth's magnetosphere as a laboratory to study the microphysics of three fundamental plasma processes: magnetic reconnection, energetic particle acceleration, and turbulence. nasascience.nasa.gov/missions/mms

MRO, launched August 12, 2005, is on a search for evidence that water persisted on the surface of Mars. nasascience.nasa.gov/missions/mars-reconnaissance-orbiter

MSL is a large, roving laboratory that will collect and analyze dozens of soil and rock samples while exploring the planet with greater range than any previous Mars rover. As planned, the robotic laboratory will carry the most advanced payload of scientific gear ever used on Mars' surface, a payload more than 10 times as massive as payloads on earlier Mars rovers. nasascience.nasa.gov/missions/msl

OCO was the latest mission in NASA's ongoing study of the global carbon cycle. It was the first spacecraft dedicated to studying atmospheric carbon dioxide, the most significant human-produced greenhouse gas and the principal human-produced driver of climate change. Due to a launch failure, the spacecraft was lost before reaching orbit (see Sub-goal 3A in the *Detailed Performance* section for more information). www.nasa.gov/mission_pages/oco/main/index.html

Opportunity, one of the Mars Exploration Rovers, landed on Mars on January 25, 2004. The rover was originally designed for a 90 Sol mission (a Sol, one Martian day, is slightly longer than an Earth day at 24 hours and 37 minutes). NASA extended this mission several times as the rover continued to make new and profound discoveries about the planet. nasascience.nasa.gov/missions/mars-rovers

Orion, also known as the Crew Exploration Vehicle, will send the next generation of explorers to the Moon, the ISS, Mars, and other destinations in the solar system. www.nasa.gov/mission_pages/constellation/orion/index.html

Parasol, a French Earth science mission, is the second microsatellite in the Myriade series that was launched on December 18, 2004. Parasol uses wide-field imaging instruments designed to improve our knowledge of the radiative and microphysical properties of clouds and aerosols by measuring the directionality and polarization of light reflected by the Earth-atmosphere system. smc.cnes.fr/PARASOL/

Phoenix, launched August 4, 2007, studied the history of water in the Martian arctic and searched for evidence of a habitable zone, and assessed the biological potential of the ice-soil boundary. nasascience.nasa.gov/missions/phoenix

Rosetta, a spacecraft on a 10-year mission to catch the comet "67P/Churyumov-Gerasimenko" (C-G), will be the first spacecraft to soft-land a robot on a comet. Rosetta will also be the first spacecraft to accompany a comet as it enters our inner solar system, observing at close range how the comet changes as the Sun's heat transforms it into the luminous apparition that has frightened and inspired people for centuries. rosetta.jpl.nasa.gov

Scout is a four-stage, solid fuel satellite system capable of launching a 385-pound satellite into a 500-mile orbit. There have been 118 Scout launches, and its overall 96-percent success rate has earned this workhorse a spot in the National Air and Space Museum. www.nasa.gov/centers/langley/news/factsheets/Scout.html

SOHO, launched on December 2, 1995, is a project of international collaboration between European Space Agency and NASA to study the Sun from its deep core to the outer corona and the solar wind. sohowww.nascom.nasa.gov/about/about.html

Spitzer Space Telescope launched August 25, 2003. During its cryogenic mission, Spitzer obtained images and spectra by detecting the infrared energy, or heat, radiated by objects in space. Most of this infrared radiation is blocked by Earth's atmosphere and cannot be observed from the ground. nasascience.nasa.gov/missions/spitzer

STEREO, launched in October 2006, is providing a unique and revolutionary view of the Sun-Earth system. The two observatories, one ahead of Earth in its orbit, the other trailing behind, trace the flow of energy and matter from the Sun to Earth. www.nasa.gov/mission_pages/stereo/main/index.html

TDRS is the communication satellite component of the Tracking and Data Relay Satellite System, which provides tracking and data acquisition services between low Earth orbiting spacecraft and control and/or data-processing facilities. The system is capable of transmitting to and receiving data from spacecraft over at least 85 percent of the spacecraft's orbit. The first TDRS was launched in 1983 on the Space Shuttle *Challenger's* first flight, STS-6. nssdc.gsfc.nasa.gov/multi/tdrs.html

THEMIS, launched in February 2007, aims to resolve one of the oldest mysteries in space physics: to determine what physical process in near-Earth space initiates the violent eruptions of the aurora that occur during sub-storms in Earth's magnetosphere. www.nasa.gov/mission_pages/themis/mission/index.html

TOPEX/POSEIDON, launched on August 10, 1992, monitored global ocean circulation, improved global climate predictions, and tracked El Niño conditions and ocean eddies. After over 62,000 orbits, the satellite has ceased operations. nasascience.nasa.gov/missions/topex-poseidon

TRACE, launched in April 1998, enables solar physicists to study the connections between fine-scale magnetic fields and the associated plasma structures on the Sun in a quantitative way by observing the photosphere, the transition region, and the corona. trace.lmsal.com

TRMM is a joint mission between NASA and the Japan Aerospace Exploration Agency (JAXA) monitors and studies tropical rainfall. The satellite was launched on November 27, 1997 from the Tanegashima Space Center in Tanegashima, Japan. trmm.gsfc.nasa.gov

Ulysses, launched on October 6, 1990, was the first mission to survey the space environment above and below the poles of the Sun. solarsystem.nasa.gov/missions/profile.cfm?MCode=Ulysses

WISE is a satellite that will carry an infrared-sensitive telescope that will image the entire sky, providing a vast storehouse of knowledge about the solar system, the Milky Way, and the universe. Among the objects WISE will study are asteroids, the coolest and dimmest stars, and the most luminous galaxies. wise.ssl.berkeley.edu/mission.html

WMAP is a NASA Explorer mission that launched June 2001 to make fundamental measurements of cosmology, the study of the properties of our universe as a whole. WMAP has been stunningly successful, producing our new Standard Model of Cosmology. WMAP continues to collect high-quality scientific data. nasascience.nasa.gov/missions/wmap